

AN ENGINEERING STUDY
FOR THE
REMOVAL AND DISPOSITION OF PCB CONTAMINATION
IN THE
WAUKEGAN HARBOR AND NORTH DITCH
AT
WAUKEGAN, ILLINOIS

ADDENDUM TO FINAL REPORT

SUBMITTED TO:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
CHICAGO, ILLINOIS
CONTRACT NO. 68-03-2647

PREPARED BY:

MASON & HANGER-SILAS MASON CO., INC.
LEXINGTON ENGINEERING OFFICE
1500 WEST MAIN
LEXINGTON, KENTUCKY 40505

MAY 1981

ADDENDUM SUMMARY

Analysis work of core borings collected from North Ditch (June 1980) and from Waukegan Harbor (November 1980 and March 1981) is now complete. This information was only partially reported in the final report submitted in January 1981.

The March 1981 Waukegan Harbor core borings showed PCB contamination on shore near the Slip #3 old outfall (now sealed off). PCB contamination was also found at least five feet into clay under the sand in muck sediments directly beneath the Slip #3 old outfall. Pockets of contamination as high as 130,000 ppm PCB were found on the shore side near the foot of the sheet piling. An estimated 3700 cubic yards of sand and clay beneath the muck sediments will have to be excavated from Slip #3 to remove contamination over 10 ppm PCB.

1.0 NORTH DITCH PCB CONTAMINATION

Core borings were collected during late May and early June 1980 throughout OMC property in order to define PCB contamination. When the January 1981 report was completed, 33 of the 39 core borings collected were analyzed for PCB and percent moisture and therefore reported. Boring numbers SC1, SC5, SC11B, SC3, B10 and B23 were not yet analyzed.

The pocket insert map presented in this report has been updated to include these six borings.

2.0 WAUKEGAN HARBOR PCB CONTAMINATION

Mason & Hanger subcontracted in November 1980 with Warzyn Engineering, Inc. to collect sand and clay samples underlying the muck sediments at six locations in Slip #3 of Waukegan Harbor. The six locations are designated B1 thru B6. The samples at each of the six locations were divided into segments and each segment analyzed for PCB and percent moisture. Some of the segments were screened to obtain density and particle sizes. Most of this information was reported in the January 1981 report. However, some PCB analyses were not completed at that time. These results are reported here.

Six additional borings (designated B6 thru B12) were collected by Warzyn Engineering on March 16-20, 1981 using a split spoon assembly. These borings were also divided into approximately 6 inch segments. Certain of these segments were selected for analysis of PCB and percent moisture.

Sample points B1 thru B12 taken in and near Slip #3 of Waukegan Harbor must not be confused with separate borings B1 thru B37 taken on OMC property. These are different borings.

Raltech Scientific Services, Inc. who completed the analytical work, reported that the PCB detected on borings B7, B9 and B12 matched most closely Aroclor 1248. The PCBs for most other borings matched Aroclor 1242.

Figure 1 shows the location of core borings B1 thru B12 in the NW end of Slip #3. Borings B1 thru B9 were taken within Slip #3 and Borings B10, B11 and B12 were taken on shore. The boundary of Slip #3 is defined by 20 foot deep sheet pilings (there may be an odd sheet piling section different than 20 foot).

The top of the sheet piling is at an elevation of approximately 581.5 to 582 feet. The water elevation on the dates the cores were taken varied from 578.9 to 579.5 feet. The bottom of the sheet piling appears to extend to the top of the underlying clay layer.

Figures 2 and 3 present PCB analysis results from selected segments of the 12 core borings. The segments were approximately 6 inches in length. Both concentrations of PCB (mg/kg or parts per million on a dry weight basis) and percent solids (dried at 105°C) are presented in Figures 2 and 3. Only a few of the selected segments were selected for PCB analysis because of the high cost (approximately \$102 per analysis).

Informal conversation with Larsen Marine, who owns the property adjacent to the north side of Slip #3, revealed that some harbor material may have been used to backfill behind the steel sheet pilings at the former OMC outfall about 15 or more years ago. Therefore three on-shore boring locations were selected.

The Slip #3 muck layers above the sand were not sampled for PCB because these sediments were already known from previous work (reported in the January 1981 report) to be heavily contaminated with PCB. Some analyses from borings B1 thru B6 were available by late December 1980, enough to conclude that a localized area of sand and clay near the former Outboard Marine Corporation discharge point was also contaminated with PCB.

Inspection of Figures 2 and 3 show that core boring locations B1, B2, B6, B7, B10 and B12 contain sand and/or clay heavily contaminated with PCB. Boring locations B3, B4, B5, B8, B11 are clean (except for some top sand contamination just below the muck layer at location B5). Boring B9 has one segment at the sand-clay boundary containing 16.6 ppm PCB; otherwise boring B9 appears clean.

The core boring analyses confirm that PCBs have sunk through the muck layer and have penetrated into the underlying sand and clay layers in the immediate vicinity of the former OMC outfall. The bottom few inches of the sand layer just above the relatively-impervious clay layer was the most contaminated with PCB, confirming that PCBs have "pooled" on top of the clay layer. The PCB concentration decreases rapidly with depth into the clay layer, dropping off to a few ppm after a clay depth of 5 feet.

PCB contamination of up to 133,000 ppm was seen in boring location B12, suggesting that PCBs have "pooled" on top of the relatively impervious clay layer, and have seeped behind the sheet piling. PCB concentrations of 126 ppm and 348 ppm were also seen in the shallow gravel behind the sheet piling believed to be fill.

Boring B12 appeared to have a silt lense locked within the sand. A sample of this material did not show PCB.

The muck layer at location B9 was about 9.0 feet deep and contained some sand occulsions and some sand mixed with the muck.

Warzyn Engineering under separate cover is submitting density measurements results, blow counts, and particle size measurements of the muck at locations B7, B8, and B9. Blow counts for sand and clay penetration at all locations were also recorded.

Plans calls for removal of the contaminated muck layer by dredging. An almost-circular cofferdam will then be built around the area of deep contamination after dredging. After dewatering, the contaminated sand and clay will be excavated.

Figure 1 illustrates possible boundary for the deep contamination into the sand and clay. More core borings are needed to determine whether shore contamination is limited to locations B10 and B12, or extends further along the sheet piling.

Project funding limited the number of borings that could be taken in March 1981, so more extensive sampling was not done at that time. Each deep boring including all analytical work and disposal of segments collected to an Ohio hazardous waste landfill costs in the neighborhood of \$4,000.

Mason & Hanger estimate the quantity of sand, gravel, and clay within the boundary of deep contamination (Figure 1) down to an average 557 foot elevation level to be 3700 cubic yards. This estimate does not include contaminated muck which would be dredged. This is the current best estimate of the amount of material which would have to be excavated.

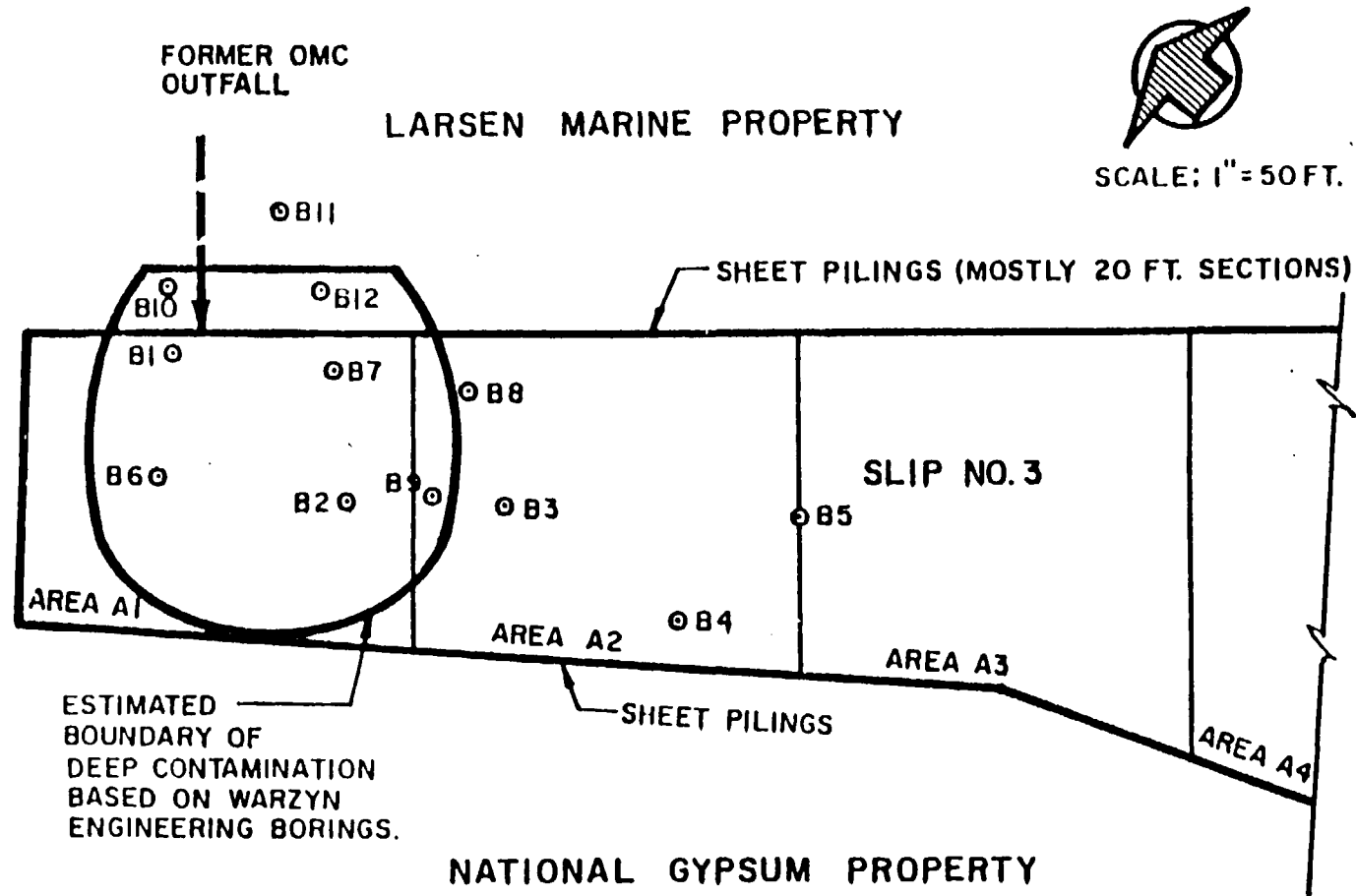
| | <u>Cubic yards</u> |
|---|--------------------|
| Excavated Sand in Slip #3 | 1,250 |
| Excavated Clay in Slip #3 | 1,250 |
| Excavated Sand, Silt and Gravel outside Slip #3 | 1,000 |
| Excavated Clay outside Slip #3 | 200 |
| Total Excavated | <u>3,700</u> |

The arithmetic average of all sand analyses taken within the boundary (including B9) is 23,000 ppm PCB. The arithmetic average of all clay analyses taken within this boundary is 1100 ppm PCB. Assuming an average moisture content of the sand or clay is 87.5 percent and the density of 110 pounds per cubic feet, the following amount of PCB is calculated within the boundary:

$$(23,000 (2250) + 1100 (1450)) (0.875) (27) (110) (10)^{-6} = 138,000 \text{ pounds}$$

This number probably represents an upper limit assuming no further undiscovered contamination. As discussed in the January 1981 report, different estimates of quantity of PCBs can be made depending upon how the numbers are grouped and averaged.

Nevertheless, both the number of cubic yards of contaminated sand and clay and pounds of PCB in this contaminated sand and clay are greater than that estimated in the January 1981 report.



- ⊙ BORINGS B1 THRU B6 NOVEMBER 19 - 22, 1980.
- BORINGS B7 THRU B12 MARCH 16 - 20, 1981.

NOTE:
PCB ANALYSES PRESENTED IN FIGURES 2 AND 3.

FIGURE 1
LOCATION OF CORE BORINGS IN NORTHWEST END OF SLIP NO. 3

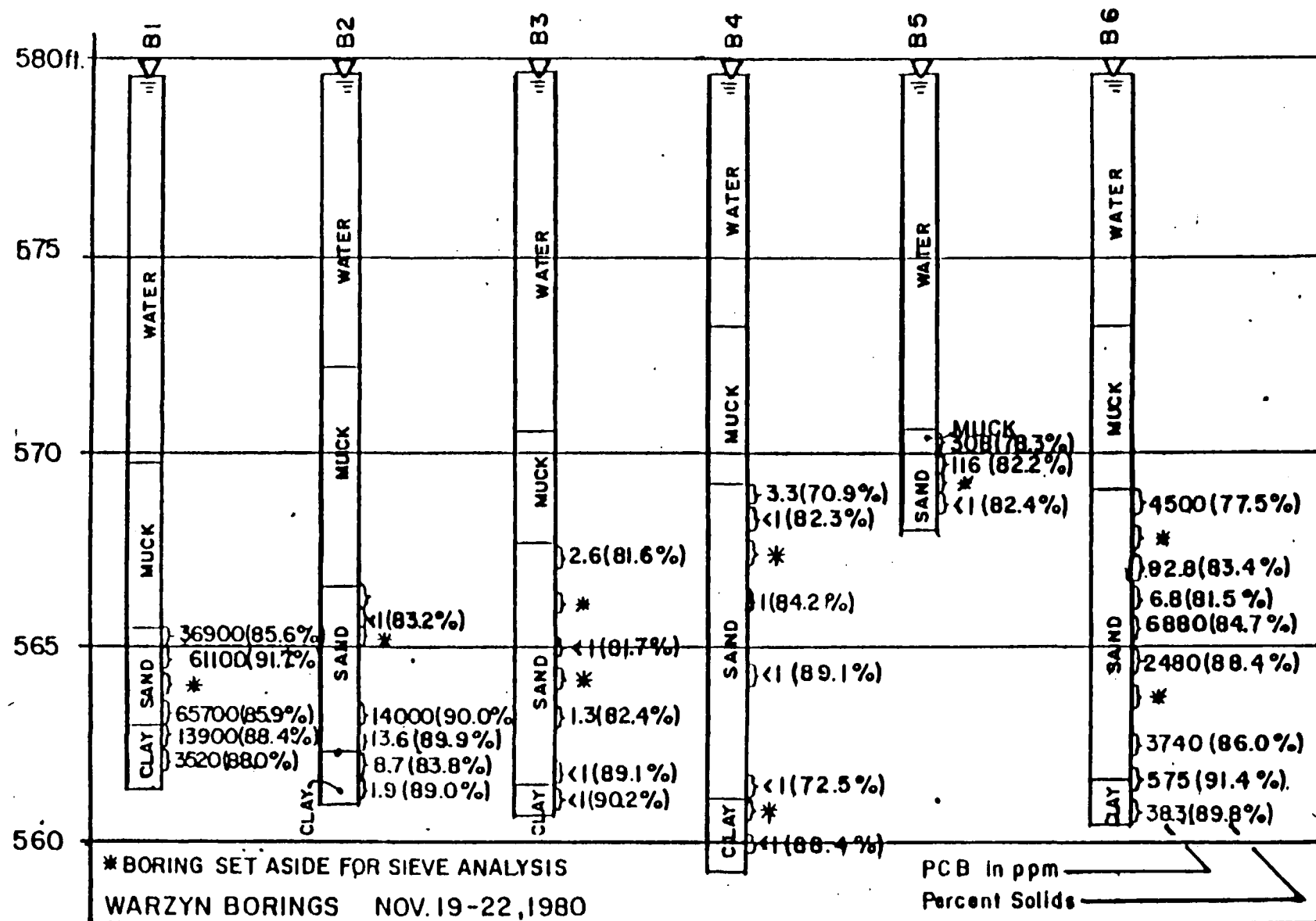


FIGURE 2
 PCB ANALYSIS OF SLIP NO. 3 CORE BORINGS B1 - B6

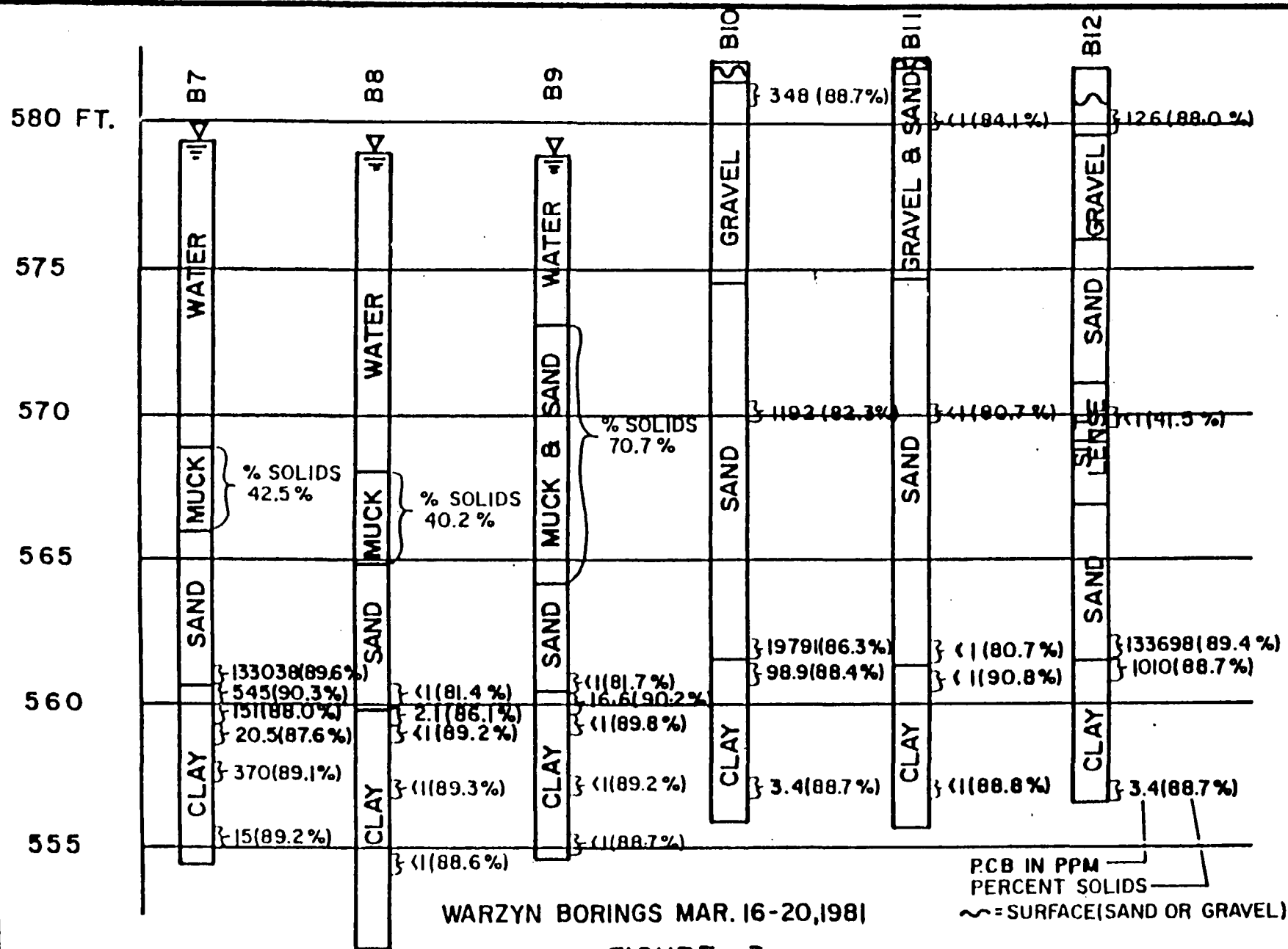


FIGURE 3

PCB ANALYSIS OF SLIP NO.3 CORE BORINGS B7 - B12